

## PATENT ABSTRACTS OF JAPAN

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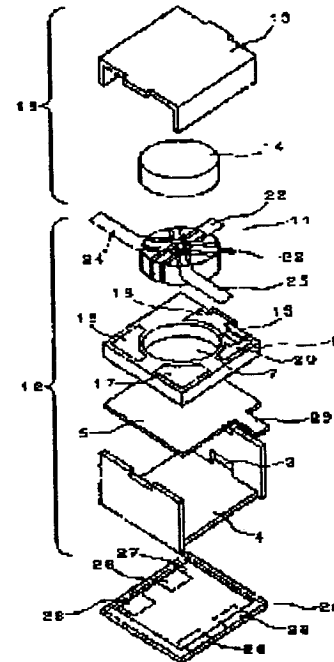
(21)Application number : **04-358247** (71)Applicant : **HITACHI FERRITE LTD**  
(22)Date of filing : **25.12.1992** (72)Inventor : **YAMAMOTO SHINJI**

### (54) NON-REVERSIBLE CIRCUIT ELEMENT

(57)Abstract:

**PURPOSE:** To attain the miniaturization and surface mounting of a non-reversible circuit element to be used for microwave bands such as VHF and UHF bands.

**CONSTITUTION:** In an isolator 1 and a circulator for a non-reversible circuit element to be used for microwave bands such as VHF and UHF bands, an insulating base 26 is mounted on the bottom of a case, I/O terminals 24, 25 projected from the element and a grounding terminal 29 are bent and fixed on the bottom of the base 26 so as to be wrapped to obtain parts mounted on the surface. In respect to internal structure, a projection part 23 is fixed as a part of a center conductor part 11 so as to be used for a substitution of a through hole. Since a projected part is fixed on a part of a dielectric base 6, the pattern area of an electrode film can be increased.



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[Patent number] 3204423

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**CLAIMS**

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[Claim(s)]

[Claim 1] Three central conductors project from a circular shield board, and a ferrite core is arranged on the shield board of this round shape. It has the central conductor section from which three aforementioned central conductors are mutually bent in the state of an insulation and which they consist of on this ferrite core. It is arranged at a hole and three aforementioned central conductors are connected to the electrode of the aforementioned dielectric substrate. this central conductor section -- the center of a dielectric substrate -- In the non-reciprocal circuit element which the permanent magnet which impresses a direct-current magnetic field to the aforementioned ferrite core is arranged, and comes to contain these in a metal case It is the non-reciprocal circuit element characterized by connecting to a dummy resistor one of the electrodes to which the aforementioned central conductor of the aforementioned dielectric substrate is connected, connecting this dummy resistor to the ground electrode further, and making connection with the ground of this ground electrode using the height formed in the aforementioned shield board.

[Claim 2] Three central conductors project from a circular shield board, and a ferrite core is arranged on the shield board of this round shape. It has the central conductor section from which three aforementioned central conductors are mutually bent in the state of an insulation and which they consist of on this ferrite core. It is arranged at a hole and three aforementioned central conductors are connected to the electrode of the aforementioned dielectric substrate. this central conductor section -- the center of a dielectric substrate -- In the non-reciprocal circuit element which the permanent magnet which impresses a direct-current magnetic field to the aforementioned ferrite core is arranged, and comes to contain these in a metal case The non-reciprocal circuit element which forms a lobe in a part of aforementioned dielectric substrate, expands substrate area, inserts this substrate lobe in the notching section formed in the metal case, and is characterized by the bird clapper.

[Claim 3] Three central conductors project from a circular shield board, and a ferrite core is arranged on the shield board of this round shape. It has the central conductor section from which three aforementioned central conductors are mutually bent in the state of an insulation and which they consist of on this ferrite core. It is arranged at a hole and three aforementioned central conductors are connected to the electrode of the aforementioned dielectric substrate. this central conductor section -- the center of a dielectric substrate -- In the non-reciprocal circuit element which the permanent magnet which impresses a direct-current magnetic field to the aforementioned ferrite core is arranged, and comes to contain these in a metal case The non-reciprocal circuit element characterized by having equipped the component side of the aforementioned metal case with the insulating substrate, having taken out the edge of the aforementioned central conductor out of the aforementioned metal case, having bent to the aforementioned insulating-substrate side, and making a surface mount possible.

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the isolator and circulator which are the non-reciprocal circuit element used for microwave bands, such as VHF and a UHF band. Moreover, this isolator and the circulator are mainly used in recent years as parts of the radio frequency head of the car telephone and cellular phone which have turned \*\*\*\* better \*\* small.

[0002]

[Description of the Prior Art] Conventionally, there is a concentrated-constant type isolator as shown in drawing 5 as a non-reciprocal circuit element currently used for microwave bands, such as VHF and a UHF band. Structural drawing of drawing 6 explains this conventional example. this isolator -- the metal case 33 top of the magnetic substance -- a grounded plate 34 -- soldering -- a it top -- the dielectric substrate 35 -- soldering -- the center of the dielectric substrate 35 -- in a hole 36, the central conductor section 41 is made to insert and it solders In addition, although the combination of the central conductor section 41 is shown in drawing 7 , the central conductor is processing and producing the copper plate and sets a ferrite core 38 to a part for the central circular part 37, and bending arrangement is carried out so that the upper surface of the ferrite core 38 may be made to insulate three central conductors 60 mutually through an insulation sheet 39 and may be made interwoven with each other every 120 degrees. Since it is necessary to make a direct-current magnetic field impress at right angles to the ferrite core 38 of the above assembly 42, it doubles so that the assembly 44 on which the metal case 40 and the magnet 43 were pasted up may be put on an assembly 42. The perspective diagram of both the flat surfaces of the above-mentioned dielectric substrate 35 is shown in drawing 8 . It is formed in the upper surface of this dielectric substrate 35 of the thick film screen printing on which three capacitor electrode layers 45, 46, and 47 printed Ag paste. It connects with one of the electrode layers 47 of this with the terminal area 51 and soldering which have come out of the central conductor section 41. This electrode layer 47 is connected to the through hole electrode layer 49 through the resistance film 48, and this through hole electrode layer 49 is connected to the ground electrode layer 50 of the inferior surface of tongue of the dielectric substrate 35 by the through hole 59. About other two electrode layers, the electrode layer 45 is connecting the terminal area 52 which has come out of the central conductor section 41, and the electrode layer 46 with the terminal area 53 and soldering which have come out of the central conductor section 41. It is made to expose to the opening 54 shell exterior of a metal case, and terminal areas 52 and 53 are taken as the input/output terminal of an isolator. In addition, as how to take the ground of an isolator, the method of carrying out soldering and the method of carrying out the screw stop of the metal case 33 are directly performed to the metal case 33 or 40.

[0003]

[Problem(s) to be Solved by the Invention] However, in order to miniaturize the above conventional isolators, only the method of making each part small could be taken fundamentally, but the size of 7mm angle was a limitation. Moreover, it can be expressed with several 1 as a rate of optimum ratio of the diameter of a magnet and a ferrite core.

[0004]

[Equation 1] Magnet: Ferrite core =1.5:1[0005] Since there is an inclination for the property of an isolator to become good so that the diameter of a ferrite core is large in order to maintain the property of an isolator after taking this ratio into consideration, it is not desirable to make the diameter of a ferrite core small. Since it is such, the gap width of face 55 of the bur which enlarged the diameter of a ferrite core as much as possible, and the dielectric substrate 35 shown in drawing 8 when it does so will become small, and the pattern area of an electrode layer 47 will become small. When the pattern area of an electrode layer became small, the danger that an electrode layer would separate occurred and the problem was in reliability. Especially width-of-face 58 portion of an electrode layer 47 tends to separate. Moreover, since the gap width of face 56 and 57 became small when the dielectric substrate became small also about the through hole, there was a problem which the cause of the crack of a substrate and the risk of ablation of an electrode layer generate. Moreover, there was also a problem that a surface mount was not made, with the structure of the conventional isolator.

[0006]

[Means for Solving the Problem] Three central conductors project this invention from a circular shield board, and a ferrite core is arranged on the shield board of this round shape. It has the central conductor section from which three aforementioned central conductors are mutually bent in the state of an insulation and which they consist of on this ferrite core. It is arranged at a hole and three aforementioned central conductors are connected to the electrode of the aforementioned dielectric substrate. this central conductor section -- the center of a dielectric substrate -- In the non-reciprocal circuit element which the permanent magnet which impresses a direct-current magnetic field to the aforementioned ferrite core is arranged, and comes to contain these in a metal case (1) One of the electrodes to which the aforementioned central conductor of the aforementioned dielectric substrate is connected is connected to a dummy resistor. Furthermore, connect with the ground electrode, and this dummy resistor forms a lobe in a part of (2) aforementioned dielectric substrate which makes connection with the ground of this ground electrode using the height formed in the aforementioned shield board, and expands substrate area to it. It is the non-reciprocal circuit element characterized by having equipped with the insulating substrate the component side of the (3) aforementioned metal cases which come to insert this substrate lobe in the notching section formed in the metal case, having taken out the edge of the aforementioned central conductor out of the aforementioned metal case, having bent to the aforementioned insulating-substrate side, and making a surface mount possible.

[0007]

[Function] About the internal structure of the non-reciprocal circuit element by this invention, this height is used as substitution of a through hole by preparing a height in a part of central conductor. Therefore, since it is not necessary to vacate an excessive hole for a dielectric substrate, it can become crack prevention of a substrate and intensity can be strengthened. Moreover, since pattern area of an electrode layer can be enlarged by preparing a lobe in a part of this dielectric substrate, the peel strength of an electrode layer improves and it is good unreliable. Moreover, according to the non-reciprocal circuit element by this invention, by equipping a case base with an insulating substrate, it bends and fixes so that the input/output terminal and grounding terminal which have come out of the element may be wrapped in an insulating-substrate base side. Thereby, surface mount-ization of a non-reciprocal circuit element can be performed. Moreover, since it is surrounded by the metal case of the magnetic substance like the conventional magnetic shielding even if it sees a magnetic circuit, the closed magnetic circuit is carried out firmly, without changing structure. Since the size of 5mm angle is also possible if it is this invention, since intensity of each part article of the internal structure of a non-reciprocal circuit element is not spoiled by the above but it can use effectively, it changes that the further miniaturization is possible. In addition, the thing in which automatic wearing by taping is also possible is not until it says.

[0008]

[Example] Hereafter, the example of this invention is explained in detail based on drawing.

Drawing 1 , drawing 2 , drawing 3 , and drawing 4 are drawings for explaining the non-reciprocal circuit element by the example of this invention, and explain an isolator. Drawing 1 is the perspective diagram (a) seen from the upper surface of the concentrated-constant type isolator which is the example of this invention article, and the perspective diagram (b) seen from the base. if structural drawing of drawing 2 explains -- this isolator 1 -- the metal case 4 top of the magnetic substance -- a grounded plate 5 -- soldering -- a it top -- the dielectric substrate 6 -- soldering -- the center of the dielectric substrate 6 -- in a hole 7, the central conductor section 11 is made to insert and it solders In addition, although the combination of the central conductor section 11 is shown in drawing 3 (a), the central conductor 8 is processing and producing the copper plate, and sets a ferrite core 9 to shield board 2 central circular portion, and bending arrangement is carried out so that the upper surface of the ferrite core 9 may be made to insulate three central conductors 8 mutually through an insulation sheet 10 and may be made interwoven with each other every 120 degrees. Since it is necessary to make a direct-current magnetic field impress at right angles to the ferrite core 9 of the above assembly 12, it doubles so that the assembly 15 on which the metal case 13 and the magnet 14 were pasted up with adhesives may be put to an assembly 12. The perspective diagram of both the flat surfaces of the above-mentioned dielectric substrate 6 is shown in drawing 4 . Three capacitor electrode layers 16, 17, and 18 are formed in the upper surface of this dielectric substrate 6 of the thick film screen printing which was able to be printed in Ag paste. Since one of the electrode layers 18 of this is connected with the terminal area 22 and soldering which have come out of the central conductor section 11 and this electrode layer 18 needs to carry out nonreflective termination, it connects with the electrode layer 20 through the resistance film 19 formed of the thick film screen printing which was able to be printed in the paste for resistance. And it has connected with the ground electrode layer 21 of the inferior surface of tongue of the dielectric substrate 6 electrically by connecting the height 23 which has come out of the central conductor section 11 to this electrode layer 20. That is, a height like 23 is given to the central conductor section 11, and it is said that the through hole is carrying out this comparatively. Moreover, what made the height of a central conductor the position of 32 of drawing 3 (b) depending on the pattern of a substrate was performed. About other two electrode layers, the electrode layer 16 is connecting the terminal area 24 which has come out of the central conductor section 11, and the electrode layer 17 with the terminal area 25 and soldering which have come out of the central conductor section 11. It is made to expose to the opening shell exterior of a metal case, and terminal areas 24 and 25 are taken as the input/output terminal of an isolator. Moreover, this dielectric substrate 6 had the lobe 31 in part, and has expanded substrate area. And electrostatic capacity is secured, while the width of face of an electrode 18 prevented the bird clapper extremely narrowly by this lobe 31 and having prevented ablation of an electrode layer. Furthermore, the notching section 3 is formed in the metal case 4, and the lobe 31 of the aforementioned dielectric substrate 6 is inserted in the notching section 3 so that this lobe 31 may not cause enlargement of a non-reciprocal circuit element. At this time, the lobe 31 of the dielectric substrate 6 projected and bent from the outside of the metal case 4, and was formed in the range. Moreover, the component-side side of the metal case 4 is equipped with the insulating substrate 26. The conductor pattern 27 is mostly formed in the field where this insulating substrate 26 contacts the metal case 4 on the whole surface, and four electrode patterns 28 are formed in the component side. And solder connection of the metal case 4 and the insulating substrate 26 is made by the aforementioned conductor pattern 27. Moreover, the input/output terminals 24 and 25 of a central conductor are bent at the component-side side of an insulating substrate 26, and are soldered with the electrode pattern 28. Moreover, a height is formed in part also about a grounded plate 5, it considers as grounding terminals 29 and 30, these grounding terminals 29 and 30 are bent to the component-side side of an insulating substrate 26, and it is soldered to the electrode pattern 28. According to the example of this invention, it could be micro and, moreover, the non-reciprocal circuit element in which a surface mount is possible was able to be constituted.

[0009]

[Effect of the Invention] The isolator which is the non-reciprocal circuit element used with VHF

of this invention and the microwave band of a UHF band usually has the function to prevent the adverse current of signals, such as microwave, and are the especially indispensable parts for destructive prevention of power amplification (amplifier) circuits, such as a walkie-talkie machine. It can be used as a surface mounted device, this invention maintaining the property of the conventional isolator. Although it is in the miniaturization of a car telephone in recent years and a cellular phone better [ \*\*\*\* ] and progress is seen, since the size of 5mm angle is also possible if it is this invention, it changes that the further miniaturization is possible. Moreover, since the number per one reel will increase also about taping at the time of packing if an isolator becomes small, there are few reels, it ends and packing cost sticks at a low price.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] They are the perspective diagram (a) seen from the upper surface of one example of this invention, and the perspective diagram (b) seen from the base.

[Drawing 2] It is structural drawing of one example of this invention.

[Drawing 3] It is structural drawing (a) and the modification of the central conductor section of one example of this invention (b).

[Drawing 4] It is the perspective diagram of both the flat surfaces of the dielectric substrate of one example of this invention.

[Drawing 5] It is the perspective diagram of the conventional example.

[Drawing 6] It is structural drawing of the conventional example.

[Drawing 7] It is structural drawing of the central conductor section of the conventional example.

[Drawing 8] It is the perspective diagram of both the flat surfaces of the dielectric substrate of the conventional example.

[Description of Notations]

- 1 Isolator
- 3 Notching Section
- 4 13 Metal case
- 5 Grounded Plate
- 6 Dielectric Substrate
- 7 Center of Dielectric Substrate -- Hole
- 8 Central Conductor
- 9 Ferrite Core
- 10 Insulation Sheet
- 11 Central Conductor Section
- 14 Magnet
- 16, 17, 18, 20 Electrode layer
- 19 Resistance Film
- 21 Ground Electrode Layer
- 22 Terminal Area
- 23 32 Height
- 24 25 Input/output terminal section
- 26 Insulating Substrate
- 27 28 Conductor pattern
- 29 30 Grounding terminal
- 31 Lobe of Dielectric Substrate

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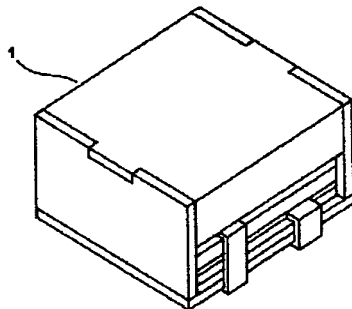
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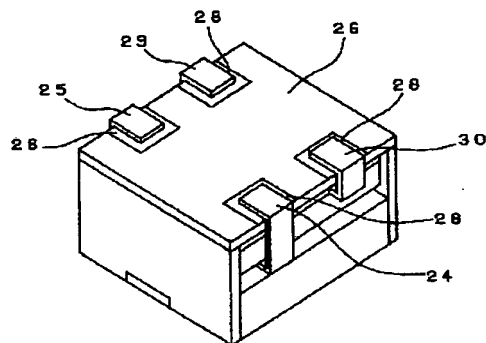
## DRAWINGS

[Drawing 1]

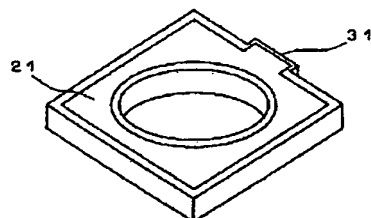
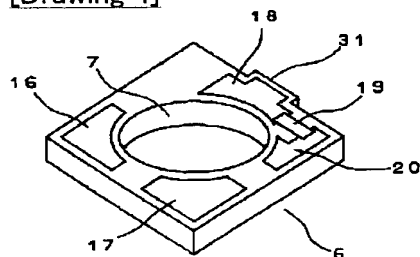
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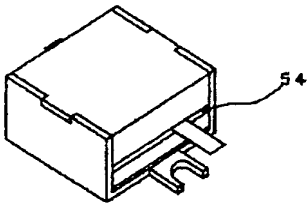
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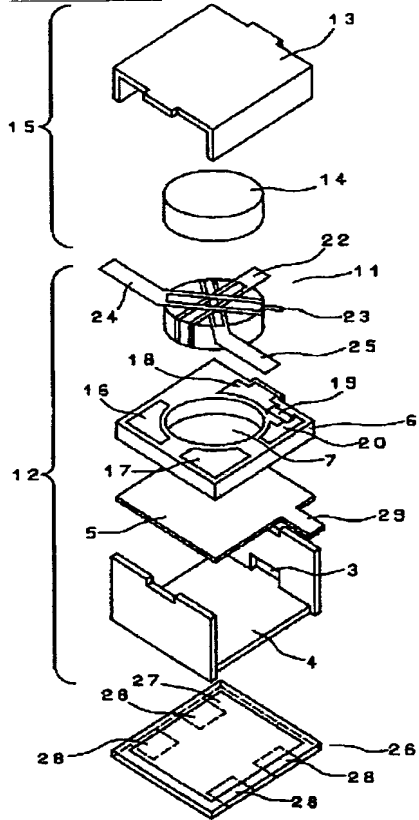
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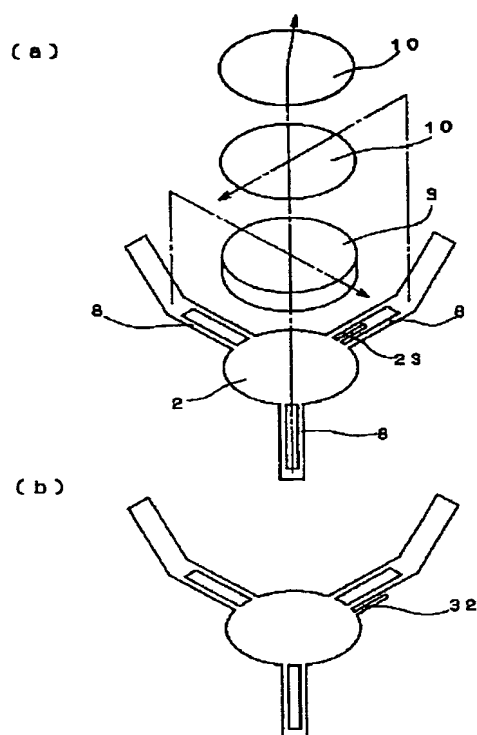
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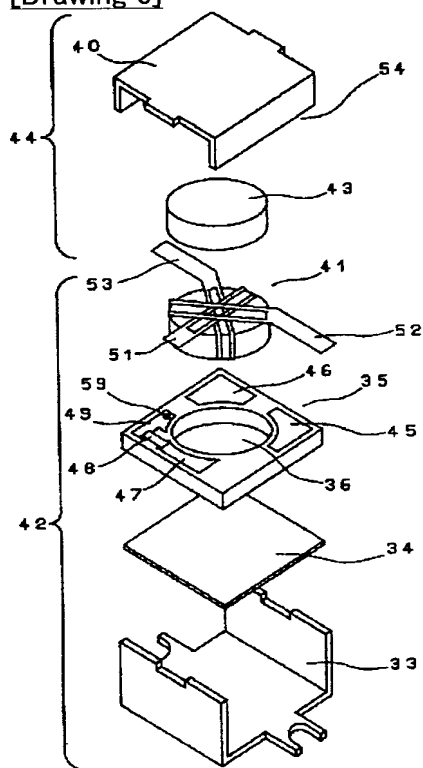
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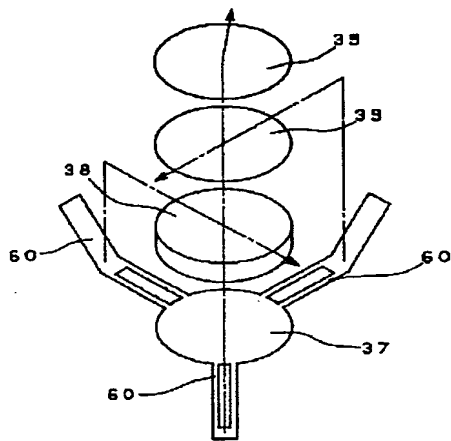
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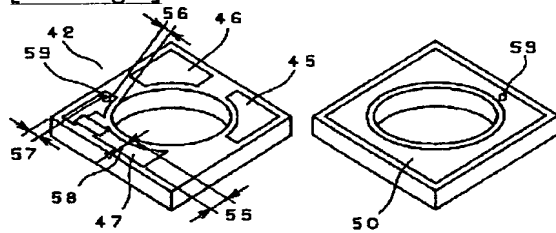
[Drawing 6]



[Drawing 7]



[Drawing 8]



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CORRECTION or AMENDMENT

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[Official Gazette Type] Printing of amendment by the convention of 2 of Article 17 of patent law.

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[Date of issue] December 24, Heisei 11 (1999).

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[Filing Number] Japanese Patent Application No. 4-358247.

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H01P 1/383  
1/36

[FI]

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1/36 A

[Procedure revision]

[Filing Date] April 28, Heisei 11.

[Procedure amendment 1]

[Document to be Amended] Specification.

[Item(s) to be Amended] Claim.

[Method of Amendment] Change.

[Proposed Amendment]

[Claim(s)]

[Claim 1] Three central conductors project from a circular shield board, and a ferrite core is arranged on the shield board of this round shape. It has the central conductor section from which three aforementioned central conductors are mutually bent in the state of an insulation and which they consist of on this ferrite core. It is arranged at a hole and three aforementioned central conductors are connected to the electrode of the aforementioned dielectric substrate. this central conductor section -- the center of a dielectric substrate -- In the non-reciprocal circuit element which the permanent magnet which impresses a direct-current magnetic field to the aforementioned ferrite core is arranged, and comes to contain these in a metal case It is the non-reciprocal circuit element characterized by connecting to a dummy resistor one of the electrodes to which the aforementioned central conductor of the aforementioned dielectric substrate is connected, connecting this dummy resistor to the ground electrode further, and making connection with the ground of this ground electrode using the height formed in the aforementioned shield board.

[Claim 2] Two or more central conductors project from a circular shield board, and a ferrite core is arranged on the shield board of this round shape. In the non-reciprocal circuit element which

has the central conductor structure of coming to bend two or more aforementioned central conductors on this ferrite core in the state of an insulation mutually and by which one of the aforementioned central conductors is connected to a dummy resistor The non-reciprocal circuit element characterized by forming the height for carrying out ground \*\*\*\* of the aforementioned dummy resistor in the aforementioned shield board apart from the aforementioned central conductor.

[Claim 3] Three central conductors project from a circular shield board, and a ferrite core is arranged on the shield board of this round shape. It has the central conductor section from which three aforementioned central conductors are mutually bent in the state of an insulation and which they consist of on this ferrite core. It is arranged at a hole and three aforementioned central conductors are connected to the electrode of the aforementioned dielectric substrate. this central conductor section -- the center of a dielectric substrate -- In the non-reciprocal circuit element which the permanent magnet which impresses a direct-current magnetic field to the aforementioned ferrite core is arranged, and comes to contain these in a metal case The non-reciprocal circuit element which forms a lobe in a part of aforementioned dielectric substrate, expands substrate area, inserts this substrate lobe in the notching section formed in the metal case, and is characterized by the bird clapper.

[Claim 4] Three central conductors project from a circular shield board, and a ferrite core is arranged on the shield board of this round shape. It has the central conductor section from which three aforementioned central conductors are mutually bent in the state of an insulation and which they consist of on this ferrite core. It is arranged at a hole and three aforementioned central conductors are connected to the electrode of the aforementioned dielectric substrate. this central conductor section -- the center of a dielectric substrate -- In the non-reciprocal circuit element which the permanent magnet which impresses a direct-current magnetic field to the aforementioned ferrite core is arranged, and comes to contain these in a metal case The non-reciprocal circuit element characterized by having equipped the component side of the aforementioned metal case with the insulating substrate, having taken out the edge of the aforementioned central conductor out of the aforementioned metal case, having bent to the aforementioned insulating-substrate side, and making a surface mount possible.

[Procedure amendment 2]

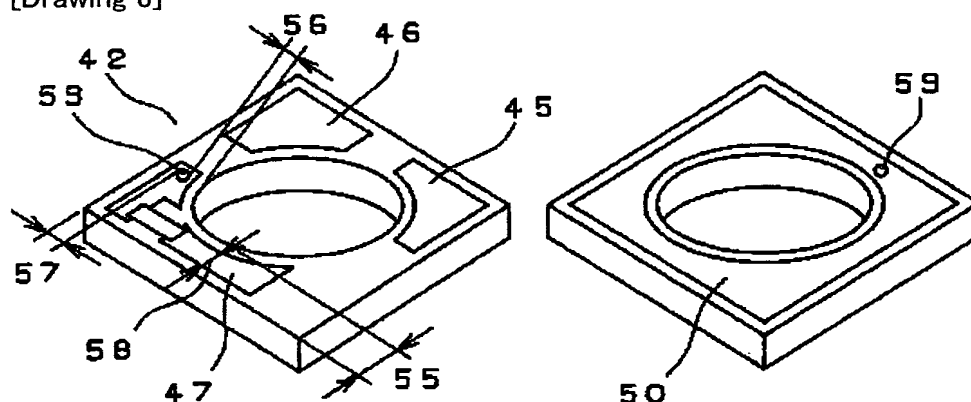
[Document to be Amended] DRAWINGS

[Item(s) to be Amended] Drawing 8.

[Method of Amendment] Change.

[Proposed Amendment]

[Drawing 8]



[Translation done.]

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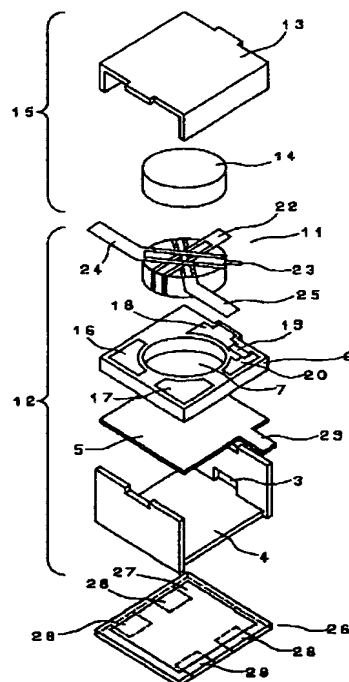
鳥取県鳥取市南栄町33番地12号日立フェ  
ライト株式会社内

(54)【発明の名称】 非可逆回路素子

(57)【要約】

【目的】 VHF、UHF帯のマイクロ波帯に使用される非可逆回路素子の超小型化及び表面実装を可能とする。

【構成】 VHF、UHF帯のマイクロ波帯に使用される非可逆回路素子のアイソレータ及びサーキュレータにおいて、ケース底面に絶縁基板を装着する事によって、素子から出ている入出力端子及びアース端子を絶縁基板底面に包む様に折り曲げて固定し、表面実装品とした。内部構造については、中心導体部の一部に突起部を設ける事によって、この突起部をスルーホール の代用として使用した。又、誘電体基板の一部に突出部を設ける事により電極膜のパターン面積を大きくした。



## 【特許請求の範囲】

【請求項 1】 円形のシールド板から 3 本の中心導体が突出し、該円形のシールド板上にフェライトコアが配置され、該フェライトコア上に前記 3 本の中心導体が互いに絶縁状態で折り曲げられて構成される中心導体部を有し、該中心導体部が誘電体基板の中央孔に配置され、前記 3 本の中心導体が前記誘電体基板の電極に接続され、前記フェライトコアに直流磁界を印加する永久磁石が配置され、これらが金属ケース内に収納されてなる非可逆回路素子において、前記誘電体基板の前記中心導体が接続される電極の一つはダミー抵抗に接続され、更に該ダミー抵抗はアース電極に接続されており、該アース電極のアースとの接続を前記シールド板に形成された突起部を用いて行うことを特徴とする非可逆回路素子。

【請求項 2】 円形のシールド板から 3 本の中心導体が突出し、該円形のシールド板上にフェライトコアが配置され、該フェライトコア上に前記 3 本の中心導体が互いに絶縁状態で折り曲げられて構成される中心導体部を有し、該中心導体部が誘電体基板の中央孔に配置され、前記 3 本の中心導体が前記誘電体基板の電極に接続され、前記フェライトコアに直流磁界を印加する永久磁石が配置され、これらが金属ケース内に収納されてなる非可逆回路素子において、前記誘電体基板の一部に突出部を形成して基板面積を拡大し、該基板突出部を金属ケースに形成された切り欠き部に挿入してなることを特徴とする非可逆回路素子。

【請求項 3】 円形のシールド板から 3 本の中心導体が突出し、該円形のシールド板上にフェライトコアが配置され、該フェライトコア上に前記 3 本の中心導体が互いに絶縁状態で折り曲げられて構成される中心導体部を有し、該中心導体部が誘電体基板の中央孔に配置され、前記 3 本の中心導体が前記誘電体基板の電極に接続され、前記フェライトコアに直流磁界を印加する永久磁石が配置され、これらが金属ケース内に収納されてなる非可逆回路素子において、前記金属ケースの実装面に絶縁基板を装着し、前記中心導体の端部を前記金属ケース外へ出し、前記絶縁基板側に折り曲げ、表面実装を可能としたことを特徴とする非可逆回路素子。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】 本発明は、VHF、UHF 帯等のマイクロ波帯に使用される非可逆回路素子であるアイソレータ、サーキュレータに関する。又、このアイソレータ、サーキュレータは近年、目ざましく小型化されている自動車電話、携帯電話の高周波部の部品として主に使用されている。

## 【0002】

【従来の技術】 従来、VHF、UHF 帯等のマイクロ波帯に使用されている非可逆回路素子として図 5 に示す様な集中定数型アイソレータがある。この従来例を図 6 の

構造図により説明する。このアイソレータは磁性体の金属ケース 33 上へアース板 34 を半田付けし、その上に誘電体基板 35 を半田付けし、その誘電体基板 35 の中央孔 36 内に中心導体部 41 を挿入させて半田付けする。尚、中心導体部 41 の組み合わせについて図 7 に示すが、中心導体は銅板を加工して作製しており、中央の円状部分 37 へフェライトコア 38 をセットし、そのフェライトコア 38 の上面に 3 本の中心導体 60 を絶縁シート 39 を介して互いに絶縁させ 120 度ごとに交錯させる様に折り曲げ配置されている。以上の組立体 42 のフェライトコア 38 には垂直に直流磁界を印加させる必要があるため、金属ケース 40 と磁石 43 を接着させた組立体 44 を組立体 42 にかぶせる様に合わせる。上記の誘電体基板 35 の両平面の斜視図を図 8 に示す。この誘電体基板 35 の上面には 3 つのコンデンサ電極膜 45、46、47 が Ag ペーストを焼き付けた厚膜印刷により形成されており、この内の一つの電極膜 47 には中心導体部 41 から出ている端子部 51 と半田付けで接続されており、この電極膜 47 は抵抗膜 48 を介してスルーホール電極膜 49 に接続され、このスルーホール電極膜 49 は、スルーホール 59 にて誘電体基板 35 の下面のアース電極膜 50 に接続されている。他の 2 つの電極膜については、電極膜 45 は、中心導体部 41 から出ている端子部 52 と、電極膜 46 は中心導体部 41 から出ている端子部 53 と半田付けで接続させている。端子部 52、53 は金属ケースの開口 54 から外部へ露出させアイソレータの入出力端子としている。尚、アイソレータのアースのとり方としては金属ケース 33、又は 40 に直接、半田付する方法や、金属ケース 33 をネジ止める方法が行われている。

## 【0003】

【発明が解決しようとする課題】 しかしながら、上記のような従来のアイソレータを小型化するためには基本的にそれぞれの部品を小さくする方法しかとれず、7mm 角の大きさが限界であった。又、磁石とフェライトコアの直径の最適比率としては、数 1 で表せられる。

## 【0004】

【数 1】 磁石：フェライトコア = 1.5 : 1

【0005】 この比率を考慮した上で、アイソレータの特性を維持するためには、フェライトコアの直径が大きい程アイソレータの特性が良くなるという傾向があるからフェライトコアの直径を小さくする事は好ましくない。そのような事からフェライトコアの直径を出来るだけ大きくしたいが、そうすると図 8 に示す誘電体基板 35 のギャップ幅 55 が小さくなり、電極膜 47 のパターン面積が小さくなってしまふ。電極膜のパターン面積が小さくなると、電極膜が剥がれる危険性が発生し信頼性に問題があった。特に、電極膜 47 の幅 58 部分は剥がれやすい。またスルーホールについても誘電体基板が小さくなればギャップ幅 56、57 が小さくなるので基板



のワレの原因、及び電極膜の剥離の危険が発生する問題があった。又、従来のアイソレータの構造では表面実装が出来ないという問題もあった。

#### 【0006】

【課題を解決するための手段】本発明は、円形のシールド板から3本の中心導体突出し、該円形のシールド板上にフェライトコアが配置され、該フェライトコア上に前記3本の中心導体が互いに絶縁状態で折り曲げられて構成される中心導体部を有し、該中心導体部が誘電体基板の中央孔に配置され、前記3本の中心導体が前記誘電体基板の電極に接続され、前記フェライトコアに直流磁界を印加する永久磁石が配置され、これらが金属ケース内に収納されてなる非可逆回路素子において、

(1) 前記誘電体基板の前記中心導体が接続される電極の一つはダミー抵抗に接続され、更に該ダミー抵抗はアース電極に接続されており、該アース電極のアースとの接続を前記シールド板に形成された突起部を用いて行う

(2) 前記誘電体基板の一部に突出部を形成して基板面積を拡大し、該基板突出部を金属ケースに形成された切り欠き部に挿入してなる

(3) 前記金属ケースの実装面に絶縁基板を装着し、前記中心導体の端部を前記金属ケース外へ出し、前記絶縁基板側に折り曲げ、表面実装を可能としたことを特徴とする非可逆回路素子である。

#### 【0007】

【作用】本発明による非可逆回路素子の内部構造については、中心導体の一部に突起部を設ける事によって、この突起部をスルーホールに代用として使用する。よって誘電体基板に余分な穴を開けずにすむので基板のワレ防止となり強度を強くする事が出来る。又、この誘電体基板の一部に突出部を設ける事により電極膜のパターン面積を大きくする事ができるので、電極膜の剥離強度が向上し信頼性も良くなる。また本発明による非可逆回路素子によれば、ケース底面に絶縁基板を装着する事によって、素子から出ている入出力端子及びアース端子を絶縁基板底面側まで包む様に折り曲げて固定する。これにより、非可逆回路素子の表面実装化が行える。又、磁気回路をみても従来の磁気シールドのように磁性体の金属ケースに囲まれているので、構造を変える事なくしっかりと閉磁路されている。以上により非可逆回路素子の内部構造の各部品の強度を損なわず有効的に利用できる。よって本発明ならば5mm角の大きさも可能なので更なる小型化が可能と成る。尚、テーピングによる自動装着も可能なのはいうまでもない。

#### 【0008】

【実施例】以下、本発明の実施例を図に基づいて詳しく説明する。図1、図2、図3、図4は本発明の実施例による非可逆回路素子を説明するための図であり、アイソレータについて説明する。図1は本発明品の実施例である集中定数型アイソレータの上面から見た斜視図(a)

と底面から見た斜視図(b)である。図2の構造図により説明すると、このアイソレータ1は、磁性体の金属ケース4上へアース板5を半田付けし、その上に誘電体基板6を半田付けし、その誘電体基板6の中央孔7内に中心導体部11を挿入させて半田付けする。尚、中心導体部11の組合せについて図3(a)に示すが、中心導体8は銅板を加工して作製しており、中央の円形のシールド板2部分へフェライトコア9をセットし、そのフェライトコア9の上面に3本の中心導体8を絶縁シート10を介して互いに絶縁させ120度ごとに交錯させる様に折り曲げ配置されている。以上の組立体12のフェライトコア9には垂直に直流磁界を印加させる必要がある。よって、金属ケース13と磁石14を接着剤にて接着させた組立体15を組立体12へかぶせる様に合わせる。上記の誘電体基板6の両平面の斜視図を図4に示す。この誘電体基板6の上面には3つのコンデンサ電極膜16、17、18がAgペーストを焼付けた厚膜印刷により形成されている。この内の一つの電極膜18は中心導体部11から出ている端子部22と半田付けにて接続されており、この電極膜18は無反射終端をする必要がある。よって、抵抗用ペーストを焼付けた厚膜印刷により形成された抵抗膜19を介して電極膜20に接続されている。そして、この電極膜20に中心導体部11から出ている突起部23を接続する事により誘電体基板6の下面のアース電極膜21に電気的に接続している。つまり、中心導体部11に、23のような突起部をもたせ、これをスルーホールがわりにしているという訳である。又、基板のパターンによっては中心導体の突起部を図3(b)の32の位置にしたものも行った。他の二つの電極膜については、電極膜16は、中心導体部11から出ている端子部24と、電極膜17は中心導体部11から出ている端子部25と半田付けで接続させている。端子部24、25は金属ケースの開口から外部へ露出させアイソレータの入出力端子としている。また、この誘電体基板6は、一部に突出部31を有し、基板面積を拡大している。そして、この突出部31により電極18の幅が極端に狭くなることを防止し、電極膜の剥離を防いでいるとともに、静電容量を確保している。更にこの突出部31が非可逆回路素子の大型化を招かないように、金属ケース4に切り欠き部3を形成しておき、その切り欠き部3に前記誘電体基板6の突出部31を挿入している。このとき、誘電体基板6の突出部31は金属ケース4の外側より突出しない範囲に形成した。また、金属ケース4の実装面側には絶縁基板26が装着されている。この絶縁基板26は、金属ケース4と当接する面にはほぼ全面に導体パターン27が形成されており、実装面には4つの電極パターン28が形成されている。そして、金属ケース4と絶縁基板26とは前記導体パターン27で半田接続されている。また、中心導体の入出力端子24、25は、絶縁基板26の実装面側に折り曲げられて、電極パ

ターン28と半田付けされている。又、アース板5についても一部に突起部を形成しアース端子29、30とし、このアース端子29、30を絶縁基板26の実装面側に折り曲げて、電極パターン28に半田付けされている。本発明の実施例により、超小型で、しかも表面実装可能な非可逆回路素子を構成することができた。

#### 【0009】

【発明の効果】本発明のVHF、UHF帯のマイクロ波帯で使用される非可逆回路素子であるアイソレータは通常、マイクロ波等の信号の逆流を防止する機能を有しており、特に無線機器等のパワーアンプ（増幅器）回路の破壊防止のために必要不可欠の部品である。本発明は従来のアイソレータの特性を維持しつつ表面実装部品として使用できる。近年の自動車電話、携帯電話の小型化には目ざましい進歩がみられるが、本発明ならば5mm角の大きさも可能なので更なる小型化が可能と成る。又、アイソレータが小型になれば梱包時のテーピングについても一リールあたりの個数が増えるのでリール数が少なく済み梱包コストが安くつく。

#### 【図面の簡単な説明】

【図1】本発明の一実施例の上面からみた斜視図（a）と、底面から見た斜視図（b）である。

【図2】本発明の一実施例の構造図である。

【図3】本発明の一実施例の中心導体部の構造図（a）と、その変形例（b）である。

【図4】本発明の一実施例の誘電体基板の両平面の斜視図である。

【図5】従来例の斜視図である。

【図6】従来例の構造図である。

【図7】従来例の中心導体部の構造図である。

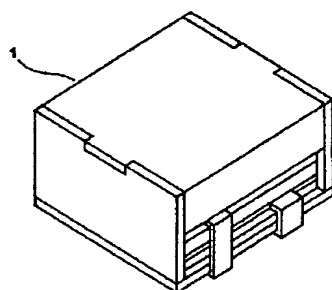
【図8】従来例の誘電体基板の両平面の斜視図である。

#### 【符号の説明】

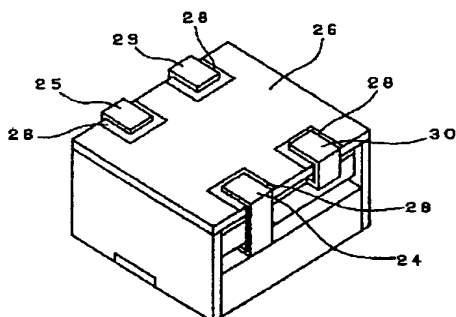
- 1 アイソレータ
- 3 切り欠き部
- 4、13 金属ケース
- 5 アース板
- 6 誘電体基板
- 7 誘電体基板の中央孔
- 8 中心導体
- 9 フェライトコア
- 10 絶縁シート
- 11 中心導体部
- 14 磁石
- 16、17、18、20 電極膜
- 19 抵抗膜
- 21 アース電極膜
- 22 端子部
- 23、32 突起部
- 24、25 入出力端子部
- 26 絶縁基板
- 27、28 導体パターン
- 29、30 アース端子
- 31 誘電体基板の突出部

【図1】

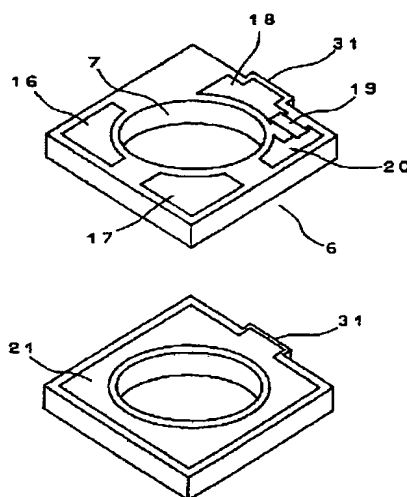
(a)



(b)



【図4】



【図5】

